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The Journal of Parasitology

Volume 7

SEPTEMBER, 1920

Number 1

WOHLFAHRTIA VIGIL (WALKER) AS A HUMAN PARASITE (DIPTERA—SARCOPHAGIDAE)

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On June 15, 1919, a Toronto surgeon called the writer by telephone and described a case of boil-like sores in an infant, from some of which he had removed small, whitish maggots. On my request to see the latter, the child and its mother were brought by the surgeon to my house, where the larvae were removed.

The patient was a female infant, two weeks old, in fair condition, though irritable almost to the point of exhaustion. The sores consisted of twelve somewhat swollen, inflamed areas, about one to two and a half centimeters in diameter, scattered over the front of the neck and arms, palms and chest. One of the palms was particularly red and swollen. On each sore there was a minute and very inconspicuous external opening. From these sores nine dipterous maggots were extracted, each from a different sore, although as some of the sores had been previously opened, it is possible that one or two of them may have contained more than a single larva. Another was removed from a spot on the shoulder on the following day, according to the mother's statement, after which operation the child recovered rapidly.

The larvae, all but two of which were more or less injured in the operation, were preserved in alcohol. They vary in length from 2.5 mm. to 4 mm., but this variation is partly due to the contraction of the injured specimens and the considerable extension of the largest uninjured one. All appear to belong to the same stage, though there is some difference in the individual size of the head segment and mouth-parts.

The sores had been noticed by the mother for the first time on the evening of June 13. The mother states that the baby had not been sleeping out of doors on that day but that the front door had been left open, so that the fly must have entered the house to deposit its young. The house is in a fairly densely populated section of North Toronto, but is less than half a mile from the ravine and wooded country in the vicinity of Reservoir Park.

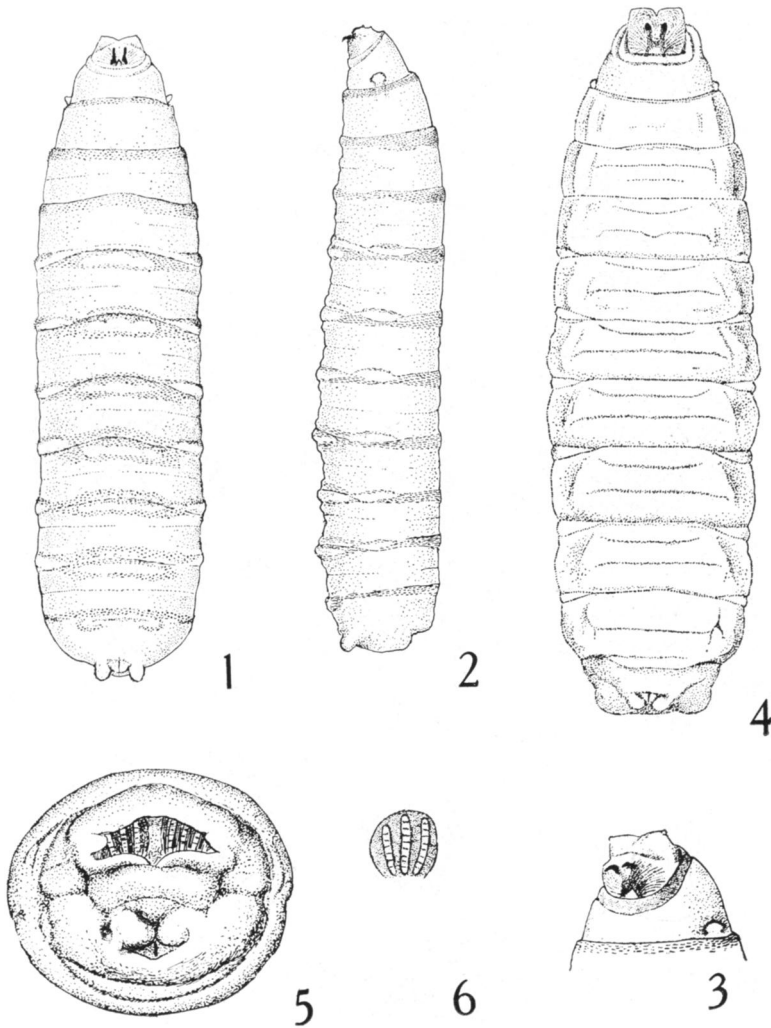


PLATE I

Fig. 1.—*Wohlfahrtia vigil* (Walk.). Larva from first case, ventral view.

Fig. 2.—Same larva, lateral view.

Fig. 3.—Same larva, ventrolateral view of anterior segments.

Fig. 4.—*Wohlfahrtia vigil* (Walk.). Larva from second case, ventral view.

Fig. 5.—Same larva, posterior view.

Fig. 6.—Same larva, left posterior spiracle.

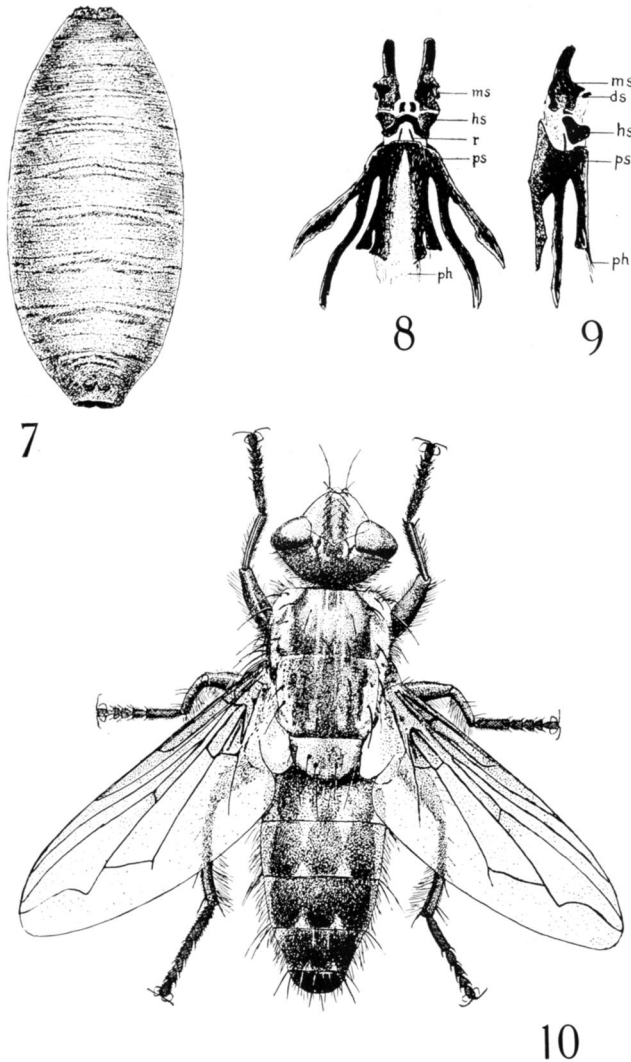


PLATE II

Fig. 7.—*Wohlfahrtia vigil* (Walk.). Ventral view of puparium.

Fig. 8.—*Wohlfahrtia vigil* (Walk.). Cephalo-pharyngeal sclerites, ventral view; *ms*, mandibular sclerite; *ds*, dental sclerite; *hs*, hypostomal sclerite; *ps*, pharyngeal sclerite; *r*, rod-like processes of pharyngeal sclerite; *ph*, floor or pharynx.

Fig. 9.—Same, lateral view, lettering as before.

Fig. 10.—*Wohlfahrtia vigil* (Walk.). Adult male.

A second case, very similar to the above, was brought to my notice on June 23 by a Toronto physician. The child, whose home was in West Toronto, was admitted to the Sick Children's Hospital on this date, and I visited the hospital in the afternoon. The patient was a female infant, eight weeks old, well grown and well nourished. There were fourteen lesions distributed upon the front of the neck, chest and anterior surface of the arms. They were of somewhat larger size than those of the first case, averaging about 2 cm. in diameter. Those on the neck were particularly swollen and inflamed. The mother had not observed anything wrong with the baby until three days previous to its admission to the hospital, when pimples appeared on the neck. On the twenty-second "worms were seen to come from the pimples."

Each swelling had a round or elliptical opening about 3 mm. in diameter and from some of these larvae were squeezed out. Usually there was a single larva in each swelling but from one of them three larvae were expelled.

When I visited the hospital some eight or nine larvae had been removed and placed upon raw beef in an incubator at body temperature. The surgeon was just completing the extraction of the remainder (about ten), which were kindly given to me for investigation. I placed them upon some raw beef in a test tube and took them home. According to the hospital record these larvae varied in length from about 5 to 15 mm. The latter measurement appears to me excessive unless the specimens were fully extended.

On the following day (June 24) the larvae had greatly increased in size and were very active, feeding on the underside of the meat. One, however, had crawled a little way up the side of the tube and, being unable to return, had died. This was preserved in 70% alcohol. On the next day the larvae were apparently full grown, measuring about 17 or 18 mm. in length (exact measurements were not made). The meat upon which they had been feeding had become extremely putrid, so I introduced a fresh piece, but they did not touch it.

On the morning of June 26 I removed the larvae and meat to a half pint jar, which I partly filled with slightly moist earth to a depth of about four inches. I then observed that only four larvae were present, all of them evidently full grown. No trace of the others remained. They could not have escaped from the tube, which was kept upright and plugged with cotton wool, and it would therefore appear that they had been devoured by the survivors. This was unfortunate, as I had intended to preserve one or two of the full grown larvae.

On the same day I took the jar containing the larvae to DeGrassi Point, Lake Simcoe, where on the following morning they had commenced to burrow into the earth. On June 28 two of the larvae were still at the surface but were becoming shorter and more oval in form. On the 29th all were beneath the surface, but two could be seen through the side of the jar and were moving somewhat actively. After this they disappeared from view.

On July 4 I dug them up. All had transformed to puparia and were at or near the bottom of the jar. I placed them upon somewhat drier earth in a breeding cage.

On July 18, about 9 p. m., I looked into the cage and saw four soft-looking pale gray flies with wings not yet expanded, crawling about the sides of the cage. One of them, while walking over the mosquito netting which covered the front of the cage, thrust its ptilinum through one of the meshes and had to be pushed back. The wings were not fully expanded until 11 a. m.

I then smeared some sweetened milk on the netting, which they devoured greedily. By the afternoon they were very active, running up and down the walls of the cage. They were readily recognized as Sarcophagids but had, to me, an unfamiliar appearance. I kept them until July 24, feeding them upon sweetened diluted milk and jam, which they took at all times of the day very readily, but on this date I found that two had died and the others were somewhat sluggish, so that, relinquishing the hope of obtaining fertilized eggs I killed the remaining two. Up to this date they had been very active.

The larvae that were kept at the hospital were reported to have "grown to two or three times their former size" on June 26, but were unfortunately destroyed when the meat upon which they were feeding became very putrid.

As in the first case the child recovered rapidly after the removal of the larvae, no secondary infections having developed.

The four flies obtained consisted of one male and three females and were readily determined from Mr. Aldrich's admirable monograph as *Wohlfahrtia vigil* (Walker) and Mr. Aldrich, to whom I sent one of the specimens, kindly confirmed my determination.

The genus *Wohlfahrtia* was erected by Aldrich (1916) for certain Sarcophagid flies formerly included in the genus *Sarcophila* and the type species *W. magnifica* (Schiner) (*Sarcophila wohlfahrti* Portchinsky) has long been known as a parasite of man and various domestic animals, particularly in Russia, having been regarded as the European analogue of the Screw-worm Fly (*Comptosia macellaria* Fabr.) of the warmer parts of America. Such habits are unknown, however, for the other European species of *Wohlfahrtia*, one of which, *W.*

meigenii, occurs also in western North America and is so closely related to the eastern species, *W. vigil*, as to be perhaps only a race of this species (vide Aldrich, 1916).

Nothing has been hitherto known of the larval habits of the North American species of *Wohlfahrtia*. Concerning *W. magnifica* several valuable papers were published between the years 1874 and 1876 by Joseph Portchinsky of St. Petersburg. A review of this work by Osten Sacken appeared in 1877 and a copy of this was very kindly sent to me by Mr. Aldrich. In this review is the following paragraph:

"In 1875-76 Portchinski published an elaborate paper, entitled 'Materials for the natural history of the flies which, in their larval stage, cause diseases among men and animals' (Trudy, etc., vol. ix, p. 3-180, with three plates). A condensation of a portion of this paper concerning *Sarcophila wohlfahrti* was published in the Horae Soc. Ent. Ross., vol. xi, 1875, pp. 123-180, in German under the title 'Krankheiten welche im Mohilewschen Gouvernement von Larven von *Sarcophila wohlfahrtia* entstehen und deren Biologie.' In 1884 a monographic essay on *Sarcophila wohlfahrti* appeared (Horae, etc., vol. xviii, p. 247-314, with 33 woodcuts), containing some new observations and comparative descriptions of this fly and its next relatives."

On Mr. Aldrich's suggestion and through the kindness of the Secretary of the Smithsonian Institution I obtained the loan of a copy of the former volume, in which Portchinsky describes a number of cases of human myiasis, caused by *Wohlfahrtia magnifica* (*Sarcophila wohlfahrti*), chiefly in children under 13 years of age. In all these cases the larvae are described as feeding gregariously upon the mucous membrane and underlying tissues of the ear, nose, gums or even the eye, or in one case an eczematous scalp; but no mention is made of the larvae ever penetrating the healthy skin, as must have occurred in the two cases of infection by *W. vigil*. In the case of a five year old boy who had a copious discharge of blood and pus from the nose there were six round openings on the upper lip, close to the nostrils, but these were probably not points of entrance as they appeared to communicate with the frontal sinus by way of the nasal cavity. The larvae would frequently come to the surface through these passages and would sometimes protrude considerably from the openings. In the cases of infection by *W. vigil* the scattered distribution of the lesions, as well as the penetration of the skin by the larvae, seem to indicate a distinctive habit, but the apparent difference from *W. magnifica* in this respect may be due merely to the difference in the ages of the hosts; the healthy skin, except that of very young infants, being perhaps impenetrable by the young larvae of either species.

In this connection it may be worth while to record that a farmer residing near Port Sydney, Ont., who is also a keen naturalist, told me that a few years ago he had suffered from severe pains in the nose, accompanied by a sensation as though something were creeping within it, and that, after a violent sneezing fit, a large maggot had dropped out; after which the trouble subsided. The capture of a specimen of *Wohlfahrtia vigil* in this locality, by Mr. N. K. Bigelow, indicates the possibility of the larva having belonged to this species.

While it is impossible to prove that the larvae from the first case belong to the same species as those from the second, the clinical features of the two cases were so very similar that I have no hesitation in considering them both to belong to *Wohlfahrtia vigil*, in spite of certain differences which are described below. These differences are not surprising in larvae which represent different stages of development; they are in fact less than those which occur in *W. magnifica*.

Figures 1 and 2 represent the largest of the larvae taken from the first case. It measures 4 mm. in length but is fully extended and agrees in all other respects with the smaller larvae from the same case. Figure 3 is a ventro-lateral view of the head of the same larva.

The two lobes into which the upper part of the pseudocephalon (cephalic segment) is divided appear somewhat less prominent than in the 3 lines long larva of *W. magnifica* figured by Portchinsky (see Osten-Sacken, 11. pl. 4, fig. 1) and the mandibular sclerites (lateral hooks) are shorter and blunter. The anterior spiracular processes are much broader than long and bear 9 to 10 minute spiracular papillae, whereas that of *W. magnifica*, figured from a 2½ lines long larva, is much longer than broad and terminates in only 4 papillae, which are long and capitate. The posterior spiracles in *W. vigil* at this stage, which is probably the second, have only two openings.

The spinules of the trunk segments are very much smaller and more restricted in distribution than in *W. magnifica*. Those of the second segment (strictly the united second and third) form a narrow ring at the front margin and are so minute as to be invisible except under high magnification (Fig. 3). Those of the other segments are larger and visible under much lower powers, but are nevertheless very minute. They are arranged, for the most part, in small, subtransverse groups of two to four. Those of the third, fourth and fifth segments are arranged in a single ring at the anterior margin of each segment, that of the third segment very narrow, those of the fourth and fifth increasing in width to nearly one third the width of the latter segment. On the remaining segments the rings of spinules are similar on the dorsal surface, but more irregular ventrally and laterally. On the ventral surface they form a transverse patch, occupying the

anterior third or more of the length of the segment and enclosing a transversely elongate bare area. These patches are confluent with a narrow band along the caudal margin of the next preceding segment, and the latter bands are continuous or subcontinuous laterally with a narrow strip of spinules along the front of the lateral fold.

In the smallest larva of *W. magnifica* figured by Portchinsky the spinules are much larger and not arranged in small groups. The spinulose bands are much more extensive. That of the second segment is much wider though described as narrow, and consists of very small spinules. The third segment is described as being bare in the middle, but provided with spinules on the front and hind margins; the third segment is entirely covered with spinules below, except a narrow bare band on the hind margin and a likewise bare, triangular, elongate space, which lies about the middle of the segment. Segments 4 to 6 are similar to segments 5 to 7 in *W. vigil* except that the spinulose bands are much broader and the enclosed bare area is divided transversely by a row of spinules. The two following segments are wholly covered with spinules, except for a narrow bare area on each and the lateral folds. Segment 9 is armed with spinules only on the anterior half, with only a few rows of spinules on the posterior half. Segment 10 presents almost the same pattern, except that the spinulose band on the front margin is narrower and the remainder of the segment almost naked. The last segment is almost entirely naked, being provided with spinules only on the middle of the front margin and at the base of the two anal papillae.

The single larva of *W. vigil* that was preserved from the second case (Figs. 4-6) belongs to a later stage than those from the first case, and though only 7 mm. long, probably shows the characteristics of the mature larva. The pseudocephalon is similar to that of the larva described above, except that the outline as seen from below is nearly square, the sides being parallel and the emargination of the front narrower. The mandibular sclerites are somewhat blunter and less curved. The posterior spiracles have three slits, like those of *W. magnifica* and other Sarcophagids. The anterior spiracular processes are like those of the earlier stage, being very short and broad, with an arcuate margin bearing 9 papillae. The spinules are wholly absent, being represented only by minute granulations which are invisible except under high magnification. They are difficult to see in the single larva preserved, but can be readily distinguished in the puparia, in which their arrangement is seen to be essentially the same as that of the spinules in the young larva (*cf.* Figs. 1 and 7).

It is worthy of note that whereas in this species the spinules are lost during development, in *W. magnifica* according to Portchinsky, they increase in both number and size, as shown in two successive

instars described and figured on plate III of the work cited above. Portchinsky believes that the great development of spines in this species is connected with its parasitic life. If this be true it would appear probable that the parasitic habit is abnormal in *W. vigil*, in which the cuticle is even less spiny than in many muscoid larvae that develop in dead organic matter.

Puparium. (Fig. 7). Length 9 to 10 mm., diameter slightly less than half the length; the ends slightly flattened; segments marked with narrow, slightly roughened bands having essentially the same arrangement as the spinules of the young larva (Fig. 1); pocket enclosing the posterior spiracles with a slightly raised margin.

In order to examine the cephalo-pharyngeal sclerites, these were removed from the inner surface of one of the empty puparia, and are shown in Figs. 8 and 9. The pharyngeal sclerites (*ps*)* are united in front, both dorsally and ventrally. Each is prolonged behind into three processes, a ventral, continuous with the floor of the pharynx, widening somewhat caudad, with a narrow, thinly chitinized area next to the hind margin, a dorsal, slightly longer, directed ecto-caudad and somewhat expanded distally, and a lateral, considerably longer than either of the others, somewhat sinuate, with slender apices. The notch between the ventral and lateral processes is somewhat deeper than that between the middle and dorsal processes. The hypostomal sclerite (*hs*) consists of two subtriangular, ventrolateral plates, united by a ventral arch with the concavity caudad. Behind and above the arch is a pair of slender, rod-like processes of the pharyngeal sclerite (*r*), and in front of the arch is a pair of small, short sclerites. The mandibular sclerites (*ms*) are not much elongated, and are rather blunt and but little decurved. Their proximal half is stout and bears a prominent ventral tooth, with which is connected the small dental sclerite (*ds*).

The female adults measure 10.5 to 11 mm. in length, the male 13 mm. The male from Port Sydney, Ont., is 12 mm. long.

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* The terminology followed here is that of C. G. Hewitt (1914:134).